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## **LDEF MATERIALS DATA BASES**

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## INTRODUCTION

The Long Duration Exposure Facility (LDEF) is a reusable, unmanned spacecraft designed to accommodate a wide variety of technology and science experiments which require long-term exposure to a known low Earth orbit (LEO) environment. The LDEF was designed to be transported into LEO via the Shuttle, free-fly for an extended time period, and be retrieved by the Shuttle for return to Earth. The LDEF was deployed on April 7, 1984 into a nearly circular 257 nautical mile orbit with a 28.4 degree inclination. On January 29, 1990, the LDEF was retrieved at a decreased altitude of 179 nautical miles after 69 months in space. During the mission life the LDEF was exposed to the range of solar conditions including solar minimum and maximum. As LDEF was gravity gradient stabilized, the leading edge of the spacecraft saw the greatest atomic oxygen (AO) exposure,  $1.47 \times 10^{23}$  atoms/in<sup>3</sup>, with the trailing edge of the spacecraft having only minimal AO exposure. The environment that the LDEF was exposed to is described in reference 1.

The LDEF Materials Special Investigation Group (MSIG) was formed to investigate the effects of long-term LEO exposure on structure and experiment materials which were not original test specimens. A significant part of the MSIG's charter is to establish and develop an electronic data base which will eventually contain the wide variety and vast quantity of electrical, thermal, optical, and mechanical materials data being generated by the MSIG members and other LDEF investigators (ref. 1,2). The MSIG chose to accomplish this task by a three-pronged approach. The first approach utilized a pre-existing global-access data base system, the Materials and Processes Technical Information System (MAPTIS), as the host for the LDEF Materials Data Base. The second approach was to build on the Optical Materials Data Base developed by the Boeing Defense & Space Group under the auspices of the Systems Special Investigation Group (SSIG) (ref. 3). The Optical Materials Data Base was expanded and four other PC/Macintosh (MAC) software-based data bases, commonly referred to as "mini-data bases", were developed.<sup>1</sup> The third approach was to develop a version of the LDEF Materials Data Base for use with PDA Engineering's M/VISION®<sup>2,3</sup> software. An overview of the capabilities and requirements of the three data bases will be discussed. Information on availability and how to access these data bases is given.

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<sup>1</sup> Work done under NASA- Langley Research Center contract NAS1-19247.

<sup>2</sup> The use of trademarks or names of manufacturers in this report is for accurate reporting and does not constitute an official endorsement, either expressed or implied, of such products or manufacturers by the National Aeronautics and Space Administration.

<sup>3</sup>M/VISION is a registered trademark of PDA Engineering.

## MAPTIS LDEF MATERIALS DATA BASE

NASA Marshall Flight Center Management has incorporated the LDEF Materials Data Base as a part of their automated storage, retrieval, and display data base system. The preliminary version of the LDEF Materials Data Base was released to MAPTIS users in June of 1992 and an updated version is currently available to all interested parties in the international space materials community. The goal of MAPTIS is to provide an efficient, reliable means of supplying the information needed for the selection and application of materials and processes to produce the hardware required for NASA's and industry's current and future space missions. MAPTIS uses ORACLE Corporation's relational data base management system and can be accessed via a modem and a 1-800 phone number or via Telnet. Users can access MAPTIS using hardware that emulates a Digital Equipment Corporation (DEC) VT100 terminal. There are several different data bases in MAPTIS, one of which is the LDEF Materials Data Base.

### MAPTIS Main Screens

The main MAPTIS menu is a two-screen menu shown in figure 1. The LDEF Materials Data Base is contained in category 4B of the main menu. Category "4A. Overview" is not operational at this time.

### Standard Menu Options

As noted in figure 1, standard menu options for the MAPTIS may be seen by typing "DO" which returns a list of frequently used commands. These commands, listed in figure 2, allow the user to switch between 132 and 80 character formats, determine standard and metric units of measure, and "move around" in the MAPTIS system.

### LDEF Materials Data Base

#### Main Screen

After entering "4B" (or "4b") from the main MAPTIS menu, the user is shown the main LDEF Materials Data Base menu, shown in figure 3. The main LDEF Materials Data Base menu has been restructured to allow the user more flexibility in terms of output formats. The main menu is divided into six categories as shown in figure 3.

On-line help screens are available throughout the LDEF Materials Data Base. They may be accessed for a given option by typing an "H" followed by the option number for which the user is requesting help. The help screens show the input information that is required for a specific option and the information included in the output. A general help

screen is also available by typing "H" from the main LDEF Materials Data Base menu. This general screen, shown in figure 4, lists specific information that the new user may find useful.

### LDEF Materials Listing

The first option on the main LDEF Materials Data Base menu is the Materials List. This option returns a list of all materials that were flown on LDEF that meet the user's search criteria. The output report tells the user which experiment the materials were flown on and whether the data base has any data on that material. The menu for this option is shown in figure 5. The materials list is searchable by the following criteria:

Materials Code- a NASA designated five (5) digit code that represents a specific manufacturer's material, part, or assembly.

Use Type- generic use of a given material (i.e., composite, thermal control blanket, etc ...)

Designation- the specific manufacturer's designation or generic trade name.

Composition- the generic chemical composition of a given material (i.e., PTFE, FEP, aluminum alloy, etc.).

Designation/Composition- both the designation and composition fields of the data base for the user supplied search string.

Specification- any government or industry specification(s) that apply to the manufacture of a given material (i.e., MIL-W-22759, BMS 5-92, etc...).

Manufacturer/Supplier- the manufacturer or supplier of a given sample.

Category (metals/nonmetals)- metals, nonmetals, or both.

Experiment Number- designated number of a given experiment.

For example, suppose a user is interested in seeing if any data are available on P1700 polysulphone resin. The user would select option "1. LDEF Materials List" from the main LDEF Materials Data Base menu. The LDEF Materials List Search Criteria menu shown in figure 5 would appear on the screen. Selecting option "3. Designation" would then prompt the user to enter the search criteria (in this case, %P1700%; the "%" is a wildcard character, using P1700% will return only the records where P1700 is the first item in the designation field and using %P1700% will return all records where P1700 is anywhere in the designation field.) When this query is executed it will retrieve all records which contain P1700 as part of the designation and will show the user which experiments contained P1700 and whether or not the data base has any data on the material. An example of the step-by-step screens to run this query are shown in figure 6. The output of this example is shown in figure 7 for the materials meeting the selected criteria. A future modification will add the contact information for the principal investigator(s).

## Basic Data Search

As shown in figure 8, the help screen for the basic data search screen, which is seen by typing "h2" at the main LDEF Materials Data Base menu, lists the type of information that is returned using the basic data search. At the main LDEF Materials Data Base menu (fig. 2) select option 2 and the LDEF Materials Data Base Basic Data Search Criteria screen, shown in figure 9, is displayed. At this point the user may choose up to three (3) search criteria.

For example, suppose the user was interested in looking at any available basic data on batteries such as the manufacturer, specification or other data as listed in figure 8. A basic data search using option "2. Use Type", and using "%batteries%" will return all basic data records on all batteries in the data base. The step-by-step screens with user required input are shown in figure 10. The report, shown in figure 11, shows that there are a number of batteries in the data base. Now the user may request more specific information on these batteries.

## Property/Value Search

The Property/Value search option is a recent addition to the data base. It was specifically designed to allow the user to search for materials property data by property value regardless of other data. The search can be performed on up to five (5) different properties at any one time, as listed on the LDEF Materials Data Base Property/Value menu shown in figure 12. As an example of a property/value search, suppose the user wanted data on all materials that had a post-flight hardness value greater than or equal to 50. A property/value search using option 12. "Hardness", and the operator >= (greater than or equal to) and value of 50 would return a list of all materials (by Use Type and designation) that had post-flight hardness values greater than 50 (with a qualifier denoting the scale of the reported property). The step-by-step screens with user required inputs are shown in figure 13. The output from this example is shown in figure 14. The information under the column heading of "DS #" is the data source number from which the data were taken. At the end of that section of data, detailed information on each specific data source is listed by data source number.

## All Data Search

The All Data option returns all available information for the materials which meet a user specified criteria. After choosing option "4. All Data", the LDEF Materials Data Base Data Menu, as shown in figure 15, is displayed. The search criteria menu for the All Data option is shown in figure 16. Options 1 through 9 of the All Data Search Criteria menu have been previously discussed in the materials list search criteria. The following descriptions cover options 10 through 16:

- Location- specific tray locations (i.e., row and/or ring number- A, E12, etc...).
- E (eV) Value- specific range of energy of atomic oxygen.

Est. Sun Hours- estimated UV solar radiation exposure.  
AO Flux Values- calculated atomic oxygen flux exposure.  
Angle of Incidence Values- a given sample's angle off of the ram direction.  
Post-Flight Value- specific post-flight value of specific properties.  
Data Sources- data source of the information (discussed in the next section).

As an example, suppose the user wants to search for all available glass transition temperature data on any T300/934 graphite/epoxy composite materials that were flown on the leading edge (row 9) or the trailing edge (row 3). The user would then select option "4. All Data" from the main LDEF Materials Data Base menu as shown in figure 13. Next, the user would select option "4f" on the LDEF Materials Data Base Data Menu for glass transition temperature data as shown in figure 15. Then the user would select option "5, 10" from the LDEF Materials Data Base All Data Search Criteria menu. At the next screen to appear (the Designation screen) the user would be prompted to enter "%T300%934%". Finally the user would be prompted to enter the location (by row and/or ring number). In this example, the user would enter "%9%" and "%3%" for the leading and trailing edges, respectively. The data base then would execute the query and return the output shown in figure 17. The basic data is returned first, followed by any atomic oxygen concentration data that exists in the data base for the given material. The atomic concentration data are the results of X-ray photoelectron spectroscopic (XPS) analyses. The first column is the specimen location on the satellite. The second column describes whether the specimen was coated, uncoated, covered, or exposed. The remaining columns list the percentage of atomic concentration of a specific element in the first 5 nanometers of the surface (unless otherwise noted). The last column (under the heading "DS") lists the data source(s) from which the data were taken. In the example shown in figure 17, data from data source 1015 and 1032 are listed. Immediately following the data listing is a list of the data sources, which gives the title and author(s) of the published paper containing the original data or, if the data come from an unpublished source, the primary facility and principal investigator(s).

#### Data Source Searches

The last type of search is the data source search. From the main LDEF Materials Data Base menu, option "5. Data Sources" allows the user to search for a particular data source by data source number, primary facility at which the testing was performed, author(s) of the published paper or principal investigator(s), or by the document title of the published paper. This search returns only the complete listing of the data source (no materials property data are returned by this option). Option "16A" through "16D" on the LDEF Materials Data Base All Data Search Criteria menu screen (fig. 16) allows the user to search by the previously described options and returns all data taken from that data source. The output from this type of search is similar to the data source portion of the output in figure 17.

## Miscellaneous Data

The final option from the main LDEF Materials Data Base Menu is Option "6. Miscellaneous Data". This option contains information that the user may find useful but that does not fall under any of the other five options. Currently option 6 contains a depiction of the LDEF satellite showing the row and ring number system used to designate locations (fig. 18).

## Changes to the LDEF Materials Data Base

This data base is a growing entity. As more published and unpublished data becomes available, it will be incorporated into the data base. Feedback from the user community is appreciated so that this data base will grow into a valuable tool for both space materials researchers and spacecraft designers. The primary motivation for constructing this data base is to provide a central storage point for the vast amount of data so that LDEF materials' results will not be lost to future researchers, engineers, and designers in the aerospace industry. Researchers having data they would like to have incorporated into the LDEF Materials Data Base or users with comments and/or suggestions are asked to contact the first author, Joan Funk.

## M/VISION

M/VISION is a materials software system, developed, and marketed by PDA Engineering, which allows for the organization and visualization of materials engineering data. M/VISION allows the user to analyze, manipulate, query and graph materials data. The M/VISION software includes graphics, spreadsheet, imaging, and modeling capabilities as well as data basing capabilities. Multiple data types, such as tabular data, graphs, and raster images (e.g., C-scans, photomicrographs, etc...) can be stored in a single M/VISION data base. M/VISION is a hybrid hierarchical/relational data base with both hierarchical and standard Structure Query Language (SQL) interfaces. An integrated engineering spreadsheet is included in the software that allows the user more efficient means to manipulate and visualize the information in the data base. Data bases can be manipulated via user-written FORTRAN and C codes.

## M/VISION LDEF Materials Data Base

In the late spring of 1993, the LDEF Materials Data Base that runs on the M/VISION software will be available to users in the international space materials community to run on their own licensed M/VISION software. A preliminary version of the data base in the M/VISION format is shown in figures 19 and 20. Figure 19 is a depiction of the M/VISION data base window with a spreadsheet window overlaid on top of it. In the data base display the user has already made several choices such as the materials,



environment, descriptors, and experiment which are shown on the far right of the display. The main portion of the data base window displays the source and reference of the data. The actual data are displayed on a previous screen. The spreadsheet illustrates the direct connection between the spreadsheet and the data base. In this spreadsheet the user requested that all materials with "\*934\*" in the designation, where "\*" is a wildcard character, which had mass loss data in terms of percent total loss and had an atomic oxygen flux value, be displayed. Also display by user-request are the property name, qualifier, post-flight value of the total mass loss and atomic oxygen flux of data meeting the given search criteria. The spreadsheet automatically calculates the log of the atomic oxygen and displays it in column F. The spreadsheet is then used as a template and data for both T300/P1700 and C6000/PMR15 that meet the mass loss and atom oxygen flux criteria are also imported into the spreadsheet. The data shown in the spreadsheet are plotted in figure 20 for all three materials. This is one example of data in the data base being manipulated by the spreadsheet and then plotted for the user's easier visualization of the data and data trends. The spreadsheet can be stored and used as a template for future comparisons.

#### COMPARISON OF THE MAPTIS AND M/VISION VERSIONS OF THE LDEF MATERIALS DATA BASE

The users of the LDEF Materials Data Base are assumed to have a wide range of computer hardware, software, and expertise. The two versions of the LDEF Materials Data Base require different hardware, software, and computer expertise. By offering the user a choice of these two versions of the data base, users may tailor their investment in hardware, software, and time. The MAPTIS version of the LDEF Materials Data Base requires relatively inexpensive computer hardware and software and allows the user to search and retrieve tabular data. The M/VISION version of the LDEF Materials Data Base requires the user to have more sophisticated hardware and software allowing the user to manipulate and analyze the data. Once the M/VISION version of the data base is transferred to the user's local machine, the data base requires only local access by the user and is available to any local networked X-device. The user can incorporate in-house data or data from other sources to augment the data base. Both versions of the LDEF Materials Data Base are available at no charge.

#### MINI-DATA BASES

Under contract to the SSIG and MSIG, Boeing Defense & Space Group has developed a series of data bases containing results from LDEF on specific topics. These data bases were developed to provide the user community with early access to LDEF data. The data bases were developed for use with PC and MAC versions of the Claris Corporation's Filemaker® Pro<sup>4</sup> software. Filemaker Pro is a flat file data base which

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<sup>4</sup>Filemaker Pro is a registered trademark of Claris Corporation.

means that the user can retrieve multiple data types such as tabular data, text, graphs, diagrams and/or picture files. The data bases' simple interface allows for easy use of the data base by the novice user. The individual data bases are password protected, allowing the user full access privileges to read, print, or download the data but not allowing the user to edit the data files. The software allows the user to search and retrieve specific information in a variety of layouts. Data can be exported to a variety of formats including ASCII. As with the other data bases, all data is traced back to its original data source. A more detailed report of the capabilities of these mini-data bases can be found in reference 3.

The mini-data bases cover the optical materials, silverized teflon thermal blankets, treated aluminum hardware, thermal control paints, and the LDEF environments areas of interest. The Optical Materials Data Base is a compilation of the results on the optical materials flown on LDEF and was originally developed by the SSIG. The Silverized Teflon Thermal Blankets Data Base covers the results from the silverized teflon thermal blankets utilized on LDEF. The Treated Aluminum Hardware Data Base is a compilation of data from the various types of aluminum hardware flown on LDEF including different alloys, surface conditions, etc. The Thermal Control Paints Data Base contains information on the wide variety of paints flown on LDEF. The LDEF Environments Data Base contains information on the environment that LDEF was exposed to, including thermal profiles, and solar UV, and AO exposure levels. Final versions of these data bases will be available by October 1993.

#### AVAILABILITY OF THE DATA BASES

For those parties interested in accessing the MAPTIS version of the LDEF Materials Data Base, a form, figure 21, is included in this paper. By filling out the form and returning it to the fax number listed on the bottom of the form, the requestor will be given a user identification name and password to MAPTIS. The M/VISION version of the LDEF Materials Data Base, once it is released to the public, will be available by contacting the first author, Joan Funk, or the third author, John Davis. Free copies of the LDEF mini-data bases will be available through December of 1994 by sending a written request including which format (PC or MAC) is being requested with a blank 3.5" floppy disk for each data base to: Gary Pippin, Technical Lead LDEF Materials Data Analysis, Boeing Defense & Space Group, P.O. Box 3999, M/S 82-32, Seattle, WA 98124-24999. After that time the data bases will be available from NASA.

#### ACKNOWLEDGEMENT

The authors thank Curt Loomis of PDA Engineering and Dr. Gary Pippin and Gail Bohnhoff-Hlavacek of Boeing Defense & Space Group for their help writing the M/VISION and mini-data bases portions of the text.

## REFERENCES

1. Levine, Arlene S., ed.: *LDEF- 69 Months In Space: First Post-Retrieval Symposium*, NASA CP-3134, January 1992.
2. Stein, Bland A.: "An Interim Overview of LDEF Materials Findings", NASA TM-107664, August 1992.
3. Bohnhoff-Hlavacek, Gail: "Databases For LDEF Results", *Second LDEF Post-Retrieval Symposium*, NASA CP-3194, Part 3, April 1993, pp. 1223-1233.

CHOICE: \_\_\_\_\_ MAPTIS - MAIN MENU  
PRESS RETURN FOR NEXT PAGE

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- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>1. MECHANICAL/PHYSICAL PROPERTY<ul style="list-style-type: none"><li>A. Metals</li><li>B. Nonmetals</li><li>C. Acoustics</li><li>D. Atomic Oxygen</li><li>E. Magnetic Materials</li><li>F. High Temperature</li><li>G. Bondline Information System</li><li>H. Nozzles Materials</li></ul></li><li>2. MATERIAL SELECTION<ul style="list-style-type: none"><li>A. Metals (MSFC-SPEC-522, etc)</li><li>B. Nonmetals (NHB 8060.1, etc)</li><li>C. Standard/Commercial Parts</li></ul></li></ul> | <ul style="list-style-type: none"><li>3. VERIFICATION &amp; CONTROL<ul style="list-style-type: none"><li>A. MUA - Mtrl Usage Agreements</li><li>B. Foreign Alloy Cross Reference</li><li>C. MIUL - Mtrl Id and Usage List</li><li>D. Intercenter Agreement Cert.Letters</li></ul></li><li>4. LONG DURATION EXPOSURE FACILITY DATA<ul style="list-style-type: none"><li>A. Overview</li><li>B. Materials SIG Data</li></ul></li><li>5. STRUCTURAL MATERIALS FAILURE ANALYSIS</li><li>6. (NOET) INFORMATION SYSTEM (NIS)<ul style="list-style-type: none"><li>A. Replacement Technology</li><li>B. Propulsion Technology (TBD)</li></ul></li></ul> |
|---|--|

CHOICE: ENTER NUMBER & ALPHA (1C GETS THE ACOUSTICS DATABASE)  
FOR HELP: ENTER H PRIOR TO CHOICE (H1C GETS HELP FOR ACOUSTICS DATABASE)  
NOTE: ENTER DO FOR LIST OF STANDARD MENU OPTIONS

CHOICE: \_\_\_\_\_ MAPTIS - MAIN MENU  
PRESS RETURN FOR PREVIOUS PAGE

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- 7. MANAGEMENT SYSTEMS FOR PROJECTS
  - A. SSF - Space Station Freedom II
  - B. NLS - National Launch System

8. SPECIFICATIONS AND STANDARDS

- 9. ADMINISTRATIVE
  - A. MSFC Form 512.5
  - B. MSFC Form 424

CHOICE: ENTER NUMBER & ALPHA (1C GETS THE ACOUSTICS DATABASE)  
FOR HELP: ENTER H PRIOR TO CHOICE (H1C GETS HELP FOR ACOUSTICS DATABASE)  
NOTE: ENTER DO FOR LIST OF STANDARD MENU OPTIONS

Figure 1. MAPTIS main screens.

CHOICE: \_\_\_\_\_

# MAPTIS - STANDARD MENU OPTIONS

OPTION	ACTION-----	OPTION	ACTION-----
0 /PM	Previous Menu	DO	Display these options
97/MM	Main Menu	DU	Display report unit of measure selection.
98/CM	Change menu display from full to brief or brief to full.	ID	Change your Query ID
99/LO	Log off the MAPTIS VAX	PW	Allow user to change their VAX Password.
AM	Activate the Action Menu	SF	Activate Systems Functions Menu
BB	Display Bulletin Board	**NOTE: FOR NONMETALS MATERIAL SELECTION TEST REPORT DATA QUERIES ONLY	
BO	Toggle between running queries online (default) & batch.		
CF	Toggle report format between 132 (default) & 80.	EXPERT	Turns off NOVICE Function
CU	Toggle report unit of measure between standard (def) & metric	NOVICE	Automatic material count, screen at time of scroll
CQ	Change action mode to Canned Query	MC	Material count prior to query report generation
DF	Display report format selection	SS	Scroll query report screen at a time
TIME	Display the Date and Time	DN	Display NOVICE Functions
PHONE	Activate the VAX Phone Utility		
MAIL	Activate the VAX Mail Utility		

Figure 2. Standard menu options for MAPTIS.

CHOICE: \_\_\_\_\_

# MAPTIS - LDEF MATERIALS DATABASE REPORT FORMAT MENU

- |                           |   |
|---------------------------|---|
| 1. LDEF materials listing | Returns general information and experiment numbers for all materials flown on the LDEF satellite. |
| 2. Basic Data             | Returns general information about the material and manufacturer.                                  |
| 3. Property/ Value        | Returns the material(s), property and property value only.  |
| 4. All Data               | Returns all available information for the material.   |
| 5. Data Sources           | Returns information about the data sources only.  |
| 6. Miscellaneous Data     | Returns information not applicable to above choices.  |

CHOICE: ENTER REPORT FORMAT CHOICE (Example: 5)  
FOR HELP: ENTER H FOR GENERAL HELP OR H AND CHOICE FOR MORE SPECIFIC HELP  
NOTE: ENTER DO TO LIST STANDARD MENU OPTIONS

Figure 3. The LDEF Materials Data Base main menu screen.

## MAPTIS - LDEF MATERIALS DATA BASE GENERAL HELP

VCM - this data found in the data base is defined as Volatile Condensible Materials according to the papers from which data has been taken.

When a query is run on the system, any data that is available that meets your search criteria will scroll across the screen as it is being retrieved and when the query is complete, you will receive a "Query Complete" message. If you receive a "Query Complete" message without seeing any data, this means there is no data currently in the system that meets your given search criteria.

The convention used for naming and describing all composites in this data base is fibers first, followed by matrix material (example: GY70 graphite fibers/934 epoxy, SP288 graphite fibers/V108 epoxy, etc...)

In this data base and throughout MAPTIS, Designation refers to the manufacturer's designation or name for a given material or the commonly referred to trade name (i.e., KAPTON, GY70 graphite fibers, etc...). Composition refers to the "generic" composition of a given material (i.e., polyimide, graphite, PTFE, FEP, etc...).

PRESS RETURN TO CONTINUE:

Figure 4. The LDEF Materials Data Base general help screen.

CHOICE: \_\_\_\_\_ LDEF MATERIALS DATABASE MATERIALS LIST SEARCH CRITERIA

1. Material Code
2. Use Type
3. Designation
4. Composition
5. Designation / Composition
6. Specification
7. Manufacturer / Supplier
8. Category (metals / non-metals)
9. Experiment Number

CHOICE: ENTER UP TO 3 SEARCH CRITERIA DELIMIT WITH A COMMA ( 2,5,6 )  
FOR HELP: ENTER H PRIOR TO ANY CHOICE ( H1 GETS HELP ON MATERIAL CODE )  
NOTE: ENTER DO TO LIST STANDARD MENU OPTIONS

Figure 5. The LDEF Materials Data Base materials list search criteria screen.

CHOICE: 1\_\_\_\_\_ MAPTIS - LDEF MATERIALS DATABASE REPORT FORMAT MENU

1. LDEF materials listing	Returns general information and experiment numbers for all materials flown on the LDEF satellite.
2. Basic Data	Returns general information about the material and manufacturer.
3. Property/ Value	Returns the material(s), property and property value only.
4. All Data	Returns all available information for the material.
5. Data Sources	Returns information about the data sources only.
6. Miscellaneous Data	Returns information not applicable to above choices.

CHOICE: ENTER REPORT FORMAT CHOICE (Example: 5)  
 FOR HELP: ENTER H FOR GENERAL HELP OR H AND CHOICE FOR MORE SPECIFIC HELP  
 NOTE: ENTER DO TO LIST STANDARD MENU OPTIONS

CHOICE: 3\_\_\_\_\_ LDEF MATERIALS DATABASE MATERIALS LIST SEARCH CRITERIA

1. Materials Code	
2. Use Type	
3. Designation	
4. Composition	
5. Designation / Composition	
6. Specification	
7. Manufacturer / Supplier	
8. Category (metals / non-metals)	
9. Experiment Number	

CHOICE: ENTER UP TO 3 SEARCH CRITERIA DELIMIT WITH A COMMA ( 2,5,6 )  
 FOR HELP: ENTER H PRIOR TO ANY CHOICE ( H1 GETS HELP ON MATERIAL CODE )  
 NOTE: ENTER DO TO LIST STANDARD MENU OPTIONS

Enter up to three designations

You must supply all wildcards (%).

Enter <CR> to terminate entry.

%P1700%\_\_\_\_\_

KEVLAR%

\_\_\_\_\_

MYLAR%

\_\_\_\_\_

%ALUMINUM%

Figure 6. Input screens for the example search on the materials list.

\*\*\*\*\* MAPTIS - LDEF MATERIALS LIST DATABASE \*\*\*\*\* 09-FEB-93

MATERIAL CODE:

USE TYPE: COMPOSITE  
DESIGNATION: C6000/P1700  
COMPOSITION: GRAPHITE FIBER WITH POLYSULPHONE  
REMARKS:

EXPERIMENT

NUMBER	TEST DATA INFORMATION
--------	-----------------------

A0134	TEST DATA AVAILABLE
-------	---------------------

\*\*\*\*\* MAPTIS - LDEF MATERIALS LIST DATABASE \*\*\*\*\* 09-FEB-93

MATERIAL CODE:

USE TYPE: COMPOSITE  
DESIGNATION: HMF 322/P1700/(+/-) 45 DEGREES  
COMPOSITION: GRAPHITE FIBERS/POLYSULPHONE  
REMARKS:

EXPERIMENT

NUMBER	TEST DATA INFORMATION
--------	-----------------------

A0171	TEST DATA AVAILABLE
-------	---------------------

\*\*\*\*\* MAPTIS - LDEF MATERIALS LIST DATABASE \*\*\*\*\* 09-FEB-93

MATERIAL CODE:

USE TYPE: STRIP  
DESIGNATION: 722 (GR/GL WEAVE)/P1700  
COMPOSITION: POLYSULPHONE

EXPERIMENT

NUMBER	TEST DATA INFORMATION
--------	-----------------------

M0003	NO TEST DATA AVAILABLE
-------	------------------------

Figure 7. Output from example search in figure 6.



## MAPTIS - LDEF MATERIALS DATABASE HELP

BASIC DATA - is the general information about the material being returned.

This data includes:

MATERIAL CODE	- NASA assigned material identifier
DESIGNATION	- Manufacturers' product identification
COMPOSITION	- Generic material makeup
USE TEMPERATURE	- Recommended temperature range for the product
USE TYPE	- Generic use of the material *Example: Adhesive, Coating
REMARKS	- Other information relating to the material
SPECIFICATION	- Specifications pertaining to the material
MANUFACTURER/ SUPPLIER	- Company that makes and/or supplies the material
ADDRESS	- Address of manufacturer/supplier

ATOMIC CONCENTRATION data will be provided when available.

NOTE: BASIC DATA will be slightly different for metallic materials.

Figure 8. The LDEF Materials Data Base basic data help screen.

CHOICE: \_\_\_\_\_ LDEF MATERIALS DATABASE BASIC DATA SEARCH CRITERIA

1. Material Code
2. Use Type
3. Designation
4. Composition
5. Designation / Composition
6. Specification
7. Manufacturer / Supplier
8. Category (metals / non-metals)

CHOICE: ENTER UP TO 3 SEARCH CRITERIAS DELIMIT WITH A COMMA ( 2,5,6 )  
FOR HELP: ENTER H PRIOR TO ANY CHOICE ( H1 GETS HELP ON DESIGNATION )  
NOTE: ENTER DO TO LIST STANDARD MENU OPTIONS

Figure 9. The LDEF Materials Data Base basic data search screen.

CHOICE: 2\_\_\_\_\_ MAPTIS - LDEF MATERIALS DATABASE REPORT FORMAT MENU

1. LDEF materials listing	Returns general information and experiment numbers for all materials flown on the LDEF satellite.
2. Basic Data	Returns general information about the material and manufacturer.
3. Property/ Value	Returns the material(s), property and property value only.
4. All Data	Returns all available information for the material.
5. Data Sources	Returns information about the data sources only.
6. Miscellaneous Data	Returns information not applicable to above choices.

CHOICE: ENTER REPORT FORMAT CHOICE (Example: 5)  
 FOR HELP: ENTER H FOR GENERAL HELP OR H AND CHOICE FOR MORE SPECIFIC HELP  
 NOTE: ENTER DO TO LIST STANDARD MENU OPTIONS

CHOICE: 2\_\_\_\_\_ LDEF MATERIALS DATABASE BASIC DATA SEARCH CRITERIA

1. Material Code	
2. Use Type	
3. Designation	
4. Composition	
5. Designation / Composition	
6. Specification	
7. Manufacturer / Supplier	
8. Category	(metals / non-metals)

CHOICE: ENTER UP TO 3 SEARCH CRITERIA DELIMIT WITH A COMMA ( 2,5,6 )  
 FOR HELP: ENTER H PRIOR TO ANY CHOICE ( H1 GETS HELP ON MATERIAL CODE )  
 NOTE: ENTER DO TO LIST STANDARD MENU OPTIONS

Enter up to three use types

You must supply all wildcards (%)

%BATTERIES%_____	Enter <CR> to terminate entry.
_____	ADHESIVE
_____	%COVER%
	STRUCTURAL%

Figure 10. Input screens for example search of basic data.

\*\*\*\*\* MAPTIS - LDEF MATERIALS DATABASE \*\*\*\*\* 11-FEB-93

MATERIAL CODE:

USE TYPE: BATTERIES  
DESIGNATION: LO-26S SX-2, D-SIZE  
COMPOSITION: LITHIUM SULFUR DIOXIDE (LI-S-O2)  
USE TEMP MIN: (f)  
USE TEMP MAX: (f)  
REMARKS: MANUFACTURER FORMERLY KNOWN AS DURACELL

MANUFACTURER: SAFT AMERICA  
DIVISION:

\*\*\*\*\* MAPTIS - LDEF MATERIALS DATABASE \*\*\*\*\* 11-FEB-93

MATERIAL CODE:

USE TYPE: BATTERIES  
DESIGNATION: DD-SIZE BATTERIES  
COMPOSITION: LITHIUM CARBON MONOFLUORIDE (LI-C-F)  
USE TEMP MIN: (f)  
USE TEMP MAX: (f)  
REMARKS:

MANUFACTURER: EAGLE-PICHER INDUSTRIES  
DIVISION:

\*\*\*\*\* MAPTIS - LDEF MATERIALS DATABASE \*\*\*\*\* 11-FEB-93

MATERIAL CODE:

USE TYPE: BATTERIES  
DESIGNATION: NICKEL-CADMIUM (NI-CD)  
COMPOSITION: NICKEL-CADMIUM (NI-CD)  
USE TEMP MIN: (f)  
USE TEMP MAX: (f)  
REMARKS:

MANUFACTURER: GENERAL ELECTRIC  
DIVISION:

Figure 11. Output from example search in figure 10.

CHOICE: \_\_\_\_\_ MAPTIS - LDEF MATERIALS DATABASE PROPERTY/ VALUE MENU

- |                                  |                           |
|----------------------------------|---------------------------|
| 1. Absorptivity                  | 14. Maximum Load          |
| 2. Absorptivity/ Emissivity      | 15. Optical Density       |
| 3. Change in Mass                | 16. Percent Elongation    |
| 4. Change in Thickness           | 17. Reaction Efficiency   |
| 5. Change in Surface Resistivity | 18. Reflectance           |
| 6. Coeff. Thermal Expansion      | 19. Shear                 |
| 7. Compression Strength          | 20. Short Circuit Current |
| 8. Elastic Modulus               | 21. State of Charge       |
| 9. Emissivity                    | 22. Surface Roughness     |
| 10. Flexural                     | 23. Tensile Strength      |
| 11. Glass Transition Temperature | 24. Thermal Strain        |
| 12. Hardness                     | 25. Transmittance         |
| 13. Load Deflection              | 26. VCM                   |

CHOICE: ENTER UP TO 5 CHOICES DELIMIT WITH COMMA ( 1,8,16 )  
FOR HELP: ENTER H AND CHOICE FOR HELP (H1)  
NOTE: ENTER DO TO LIST STANDARD MENU OPTIONS

Figure 12. The LDEF Materials Data Base Property/ Value search screen.

CHOICE: 3 \_\_\_\_\_

MAPTIS - LDEF MATERIALS DATABASE REPORT FORMAT MENU

- |                           |   |
|---------------------------|---|
| 1. LDEF materials listing | Returns general information and experiment numbers for all materials flown on the LDEF satellite. |
| 2. Basic Data             | Returns general information about the material and manufacturer.                                  |
| 3. Property/ Value        | Returns the material(s), property and property value only.  |
| 4. All Data               | Returns all available information for the material.   |
| 5. Data Sources           | Returns information about the data sources only.  |
| 6. Miscellaneous Data     | Returns information not applicable to above choices.  |

CHOICE: ENTER REPORT FORMAT CHOICE (Example: 5)  
FOR HELP: ENTER H FOR GENERAL HELP OR H AND CHOICE FOR MORE SPECIFIC HELP  
NOTE: ENTER DO TO LIST STANDARD MENU OPTIONS

CHOICE: 12 \_\_\_\_\_

MAPTIS - LDEF MATERIALS DATABASE PROPERTY/ VALUE MENU

- |                                  |                           |
|----------------------------------|---------------------------|
| 1. Absorptivity                  | 14. Maximum Load          |
| 2. Absorptivity/ Emissivity      | 15. Optical Density       |
| 3. Change in Mass                | 16. Percent Elongation    |
| 4. Change in Thickness           | 17. Reaction Efficiency   |
| 5. Change in Surface Resistivity | 18. Reflectance           |
| 6. Coeff. Thermal Expansion      | 19. Shear                 |
| 7. Compression Strength          | 20. Short Circuit Current |
| 8. Elastic Modulus               | 21. State of Charge       |
| 9. Emissivity                    | 22. Surface Roughness     |
| 10. Flexural                     | 23. Tensile Strength      |
| 11. Glass Transition Temperature | 24. Thermal Strain        |
| 12. Hardness                     | 25. Transmittance         |
| 13. Load Deflection              | 26. VCM                   |

CHOICE: ENTER UP TO 5 CHOICES DELIMIT WITH A COMMA ( 1,8,16 )  
FOR HELP: ENTER H AND CHOICE FOR HELP (H1)  
NOTE: ENTER DO TO LIST STANDARD MENU OPTIONS

Do you want the value in HARDNESS  
to be ( =, NOT=, <, <=, >, >= )

Enter value (numeric)

>= \_\_\_\_\_

50.0 \_\_\_\_\_

Figure 13. Input screens for example of property/value search.

MAPTIS - LDEF MATERIALS DATABASE PROPERTY / VALUE SEARCH

USE TYPE	DESIGNATION	PROPERTY NAME	QUALIFIER	PRE-FLT	POST-FLT	UNITS	DS #
STRUCTURAL/COVER PLATE/CLAMPS	AL 2024-T6 CHROMIC ACID ANODIZED	HARDNESS	ROCKWELL B-SCALE		60.0		1021
	AL 2024-T6 CHROMIC ACID ANODIZED	HARDNESS	ROCKWELL B-SCALE		60.0		1021
	AL 2024-T6 CHROMIC ACID ANODIZED	HARDNESS	ROCKWELL B-SCALE		61.0		1021
	AL 2024-T6 CHROMIC ACID ANODIZED	HARDNESS	ROCKWELL B-SCALE		61.0		1021
	AL 2024-T6 CHROMIC ACID ANODIZED	HARDNESS	ROCKWELL B-SCALE		62.0		1021
	AL 2024-T6 CHROMIC ACID ANODIZED	HARDNESS	ROCKWELL B-SCALE		63.0		1021
	AL 2024-T6 CHROMIC ACID ANODIZED	HARDNESS	ROCKWELL F-SCALE		91.0		1021
	AL 2024-T6 CHROMIC ACID ANODIZED	HARDNESS	ROCKWELL F-SCALE		91.0		1021
	AL 2024-T6 CHROMIC ACID ANODIZED	HARDNESS	ROCKWELL F-SCALE		91.5		1021
	AL 2024-T6 CHROMIC ACID ANODIZED	HARDNESS	ROCKWELL F-SCALE		91.5		1021
	AL 2024-T6 CHROMIC ACID ANODIZED	HARDNESS	ROCKWELL F-SCALE		92.0		1021
	AL 2024-T6 CHROMIC ACID ANODIZED	HARDNESS	ROCKWELL F-SCALE		93.0		1021

DATA SOURCE

DATA SOURCE: 1021  
 FACILITY: PHILLIPS LABORATORY (WSMD) KIRTLAND AFB  
 DOCUMENT TYPE: TECHNICAL PAPER PRESENTED AT LDEF SYMPOSIUM, JUNE 1991  
 IDENTIFICATION: CP-3134, PART 2  
 TITLE: EFFECTS OF SPACE ENVIRONMENT ON STRUCTURAL MATERIALS  
 REMARK: C. MIDLIONICO, C. STEIN, R. ROYBAL, R. ROBERTSON; DEPARTMENT OF METALLURGICAL AND MATERIALS  
 ENGINEERING-UNIVERSITY OF TEXAS AT EL PASO, L.E. MURR, S. QUINONES, J. RIVAS, B. MARQUEZ, A.H. ADVANI, W.W.  
 FISHER, R. ARROWOOD

Figure 14. Output from example search in figure 13.

CHOICE: \_\_\_\_\_

MAPTIS - LDEF MATERIALS DATABASE DATA MENU

- |                              |                                  |                        |
|------------------------------|----------------------------------|------------------------|
| 1. All Available Properties  | 4. General Properties            |                        |
| 2. Electrical Properties     | A. All General Properties        | I. VCM                 |
| A. All Electrical Properties | B. Change in Mass                | J. Reaction Efficiency |
| B. State of Charge           | C. Change in Thickness           |                        |
| C. Short Circuit Current     | D. Optical Density               |                        |
|                              | E. Surface Roughness             |                        |
| 3. Mechanical Properties     | F. Glass Transition Temperature  |                        |
| A. All Mechanical Properties | G. Change in Surface Resistivity |                        |
| B. Elastic Modulus           |                                  |                        |
| C. Tensile Strength          | 5. Optical/Thermal Properties    |                        |
| D. Hardness                  | A. All Opt./Thermal Properties   |                        |
| E. Maximum Load              | B. Absorptivity                  |                        |
| F. Shear                     | C. Emissivity                    | I. Thermal Strain      |
| G. Flexural                  | D. Absorptivity/Emissivity       |                        |
| H. Compression Strength      | E. Reflectance                   |                        |
| I. Load Deflection           | F. Transmittance                 |                        |
| J. Percent Elongation        | G. Coeff. Thermal Expansion      |                        |

CHOICE: ENTER UP TO 3 CHOICES DELIMIT WITH A COMMA ( 3C,4A,5D )  
FOR HELP: ENTER H FOR GENERAL HELP OF H AND CHOICE FOR MORE SPECIFIC HELP  
NOTE: ENTER DO TO LIST STANDARD MENU OPTIONS

Figure 15. The LDEF Materials Data Base all data search menu.

CHOICE: \_\_\_\_\_

LDEF MATERIALS DATABASE ALL DATA SEARCH CRITERIA

- |                                   |                                 |
|-----------------------------------|---------------------------------|
| 1. Material Code                  | 10. Location                    |
| 2. Use Type                       | 11. E (eV) value                |
| 3. Designation                    | 12. Est. Sun Hours              |
| 4. Composition                    | 13. AO Flux value               |
| 5. Designation / Composition      | 14. Angle of Incidence value    |
| 6. Specification                  | 15. Post Flight Value           |
| 7. Manufacturer / Supplier        | 16. DATA SOURCES                |
| 8. Category (metals / non-metals) | A. Data Source Number           |
| 9. Experiment Number              | B. Primary Facility             |
|                                   | C. Author or Secondary Facility |
|                                   | D. Document Title               |

CHOICE: ENTER UP TO 3 SEARCH CRITERIA DELIMIT WITH A COMMA ( 2,5,6 )  
FOR HELP: ENTER H PRIOR TO ANY CHOICE ( H3 GETS HELP ON DESIGNATION )  
NOTE: ENTER DO TO LIST SYTANDARD MENU OPTIONS

Figure 16. The LDEF Materials Data Base all data search criteria menu.

\*\*\*\*\* MAPTIS - LDEF MATERIALS DATABASE \*\*\*\*\* 09-APR-93

MATERIAL CODE: 05321

USE TYPE: LAMINATE/COMPOSITE

DESIGNATION: THORNEL T300/934

COMPOSITION: PAN BASE CARBON WITH EPOXY

USE TEMP MIN: (f)

USE TEMP MAX: (f)

REMARKS:

SPECIFICATION: MIL-C-83286

MANUFACTURER: IMPERIAL CHEMICAL INDUSTRIES

DIVISION: ICI AMERICAS INCORPORATED/FIBERITE

MANUFACTURER: AMOCO CORPORATION

DIVISION: (FORMERLY UNION CARBIDE)

ATOMIC CONCENTRATION DATA

LOCATION	MATERIAL SIDE	DS #
----------	---------------	------

-----	-----	----
-------	-------	------

B9	COVERED SIDE, COATED	1032
----	----------------------	------

Figure 17. Example output for an all data search.



AG	AL	C	CL	CU	F	IN	K	N	NA	O	PB	S	SI	SN	ZN
-----															
65.1										29.7			2.4		
62.8				2.0				1.7		24.8			3.4		
28.9										47.6			11.8		
54.3										33.0			7.5		
49.7								0.5		34.0			13.0		
66.1								0.40		23.3			3.60		
52.7								1.70		32.1			11.8		
64.5								0.50		25.7			4.30		

GENERAL PROPERTY EFFECTS DATA

PROPERTY NAME: GLASS TRANSITION TEMPERATURE	QUALIFIER:
PRE-FLT: 204	POST-FLT: 192
UNITS: DEGREES C	
MATERIAL SIDE: EXPOSED SIDE	LOCATION: D9
SUBSTRATE:	
EXPERIMENT #: M0003-8	
SAMPLE THICK:	SAMPLE TEMP:
EXPOSURE TIME: 5.77 (yrs)	
EST. SUN HRS: 11100	A-O FLUX AOI: 82 (deg)
E: 5 (ev)	
FLUX: 9.16E+13 (atom/cm2*s)	A-O FLUENCE:

Figure 17 (continued). Example output for an all data search.

DATA SOURCE #: 1015

COMMENT: PRE-FLIGHT VALUE IS PUBLISHED VALUE, POST-FLIGHT VALUE IS ACTUAL  
MEASUREMENT

PROPERTY NAME: GLASS TRANSITION TEMPERATURE QUALIFIER:  
PRE-FLT: 204 POST-FLT: 193  
UNITS: DEGREES C  
MATERIAL SIDE: EXPOSED SIDE LOCATION: D3  
SUBSTRATE:  
EXPERIMENT #: M0003-8

SAMPLE THICK:  
EXPOSURE TIME: 5.77 (yrs)  
EST. SUN HRS: 11100  
E: 5 (ev)  
FLUX: 4.08E-05 (atom/cm2\*s) A-O FLUENCE:  
A-O FLUX AOI: 82 (deg)

SAMPLE TEMP:

DATA SOURCE #: 1015

COMMENT: PRE-FLIGHT VALUE IS PUBLISHED VALUE, POST-FLIGHT VALUE IS ACTUAL  
MEASUREMENT

DATA SOURCE

DATA SOURCE: 1015 DATE: 30-JUN-91  
FACILITY: BOEING DEFENSE AND SPACE GROUP  
DOCUMENT TYPE: TECHNICAL PAPER PRESENTED AT LDEF SYMPOSIUM, JUNE 1991  
IDENTIFICATION: CP-3134, PART 2  
TITLE: RESULTS FROM ANALYSIS OF BOEING COMPOSITE SPECIMENS FLOWN ON LDEF EXPERIMENT M0003  
REMARK: PETE E. GEORGE, SYLVESTER G. HILL

Figure 17 (continued). Example output for an all data search.

DATA SOURCE: 1032	DATE: 30-NOV-91
FACILITY: NASA LANGLEY RESEARCH CENTER	
DOCUMENT TYPE: TECHNICAL PAPER AT LDEF MATERIALS WORKSHOP, NOV. 1991	
IDENTIFICATION: CP-3162, PART 1	
TITLE: CHARACTERIZATION OF SELECTED LDEF-EXPOSED POLYMERIC FILMS AND RESINS	
REMARK: PHILIP R. YOUNG, WAYNE S. SLEMP	
DATA SOURCE: 1035	DATE: 30-NOV-91
FACILITY: UNIVERSITY OF TORONTO INSTITUTE FOR AEROSPACE STUDIES	
DOCUMENT TYPE: TECHNICAL PAPER PRESENTED AT LDEF MATERIALS WORKSHOP, NOV 91	
IDENTIFICATION: CP-3162, PART 2	
TITLE: ADDITIONAL RESULTS ON SPACE ENVIRONMENTAL EFFECTS ON POLYMER MATRIX COMPOSITES -	
EXPERIMENT AO180	
REMARK: R. C. TENNYSON	

Figure 17 (concluded). Example output for an all data search.

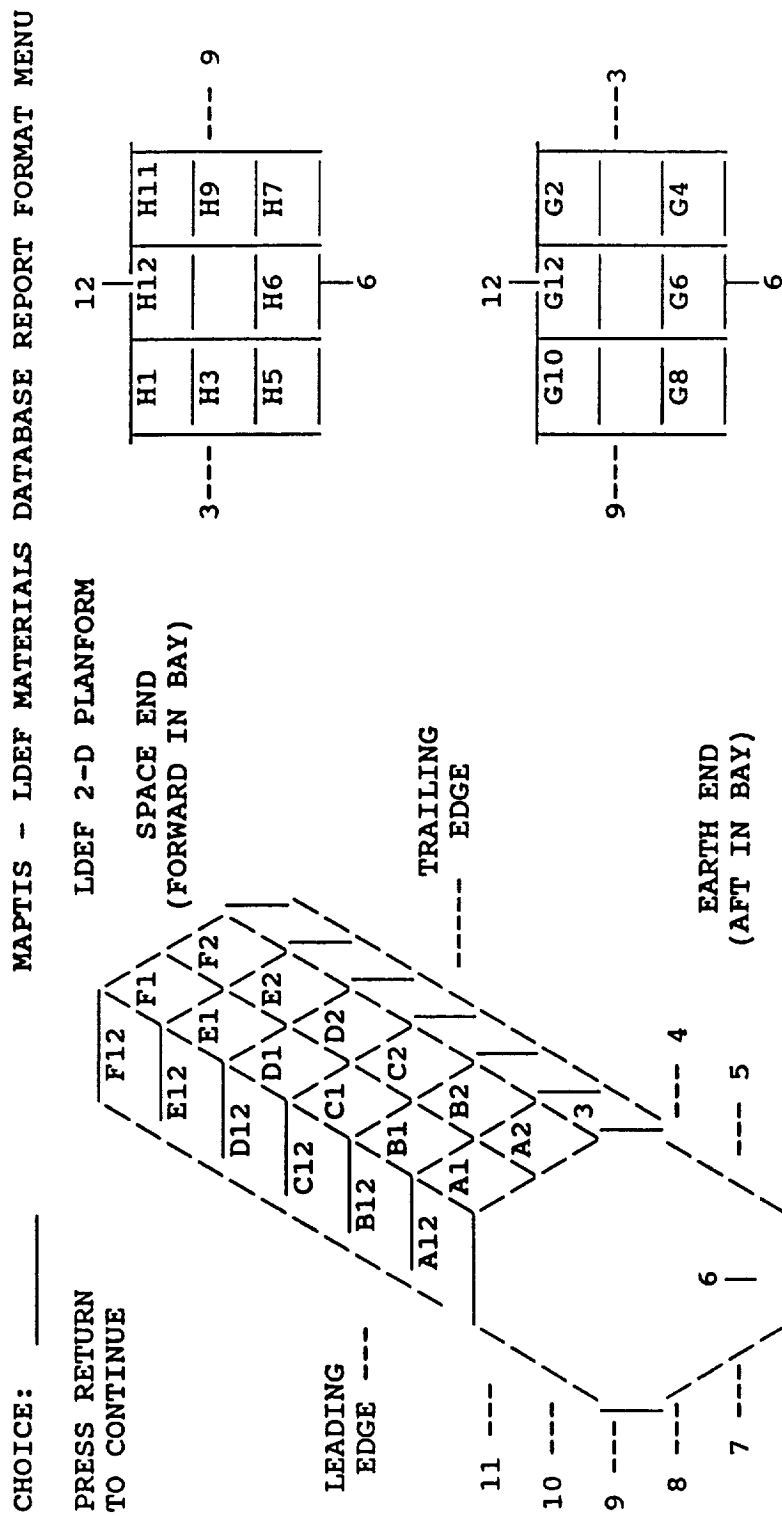


Figure 18. Miscellaneous data display.

TEST>>

FILE

SCHEMA

DATABASE

ASET

RUN

TEST, RUN>>

SPREADSHEET

GRAPHICS

IMAGING

END

APPLICATION

MATERIAL

DESCRIPTORS

EXPERIMENTAL

DATA\_ORIGIN

FACILITY

DOC-TYPE

BOEING DEFENSE AND SPACE GROUP

TECHNICAL PAPER PRESENTED AT LDEF SYMPOSIUM, JUNE 1991

USE TYPE

COMPOSITE

DESIG

934 EPOXY/T300 GRAPHITE

GRP

N

COMM

934 EPOXY/T300 GRAPHITE

PROP

MASS CHANGE

NAME

QUALIFE

% TOTAL LOSS

R

EXPERIME

M0003-B

NT

LOCATION

D3

MITRL

EXPOSED SIDE

SIDE

ESH

11100, HRS

FLUX

4.08-5 ATOMS/SQ.CM\*2

TIME

5.77 YRS

E\_EV

5 (e V)

EXP

SAMPLE WAS THERMALLY CYCLED PRIOR TO FLIGHT

COMMENT

UTILITIES

STOP

snapshot

File Edit Function Database Format Display

DESIG

A	B	C	D	E	F
1	934 epoxy/T300 graphite				
2					
3	DESIG LIKE "934" AND PROP NAME LIKE "MASS" AND QUALIFIER LIKE "total loss" and FLUXEX				
4	DESIG	PROP NAME LIKE	QUALIFIER	POST FLT	Log (Flux)
5	934 epoxy/T300 >	MASS CHANGE	% TOTAL LOSS	0.26	8.36e+13
6	934 epoxy/T300 >	MASS CHANGE	% TOTAL LOSS	0.28	4.06e+05
7	934 epoxy/T300 >	MASS CHANGE	% TOTAL LOSS	0.29	4.06e+05
8	934 epoxy/T300 >	MASS CHANGE	% TOTAL LOSS	0.34	8.36e+13
9					
10					
11					
12					
13	p1700 polyethelene/T300 graphite				

Figure 19. An example of the data base and spreadsheet screens of the M/VISION version.

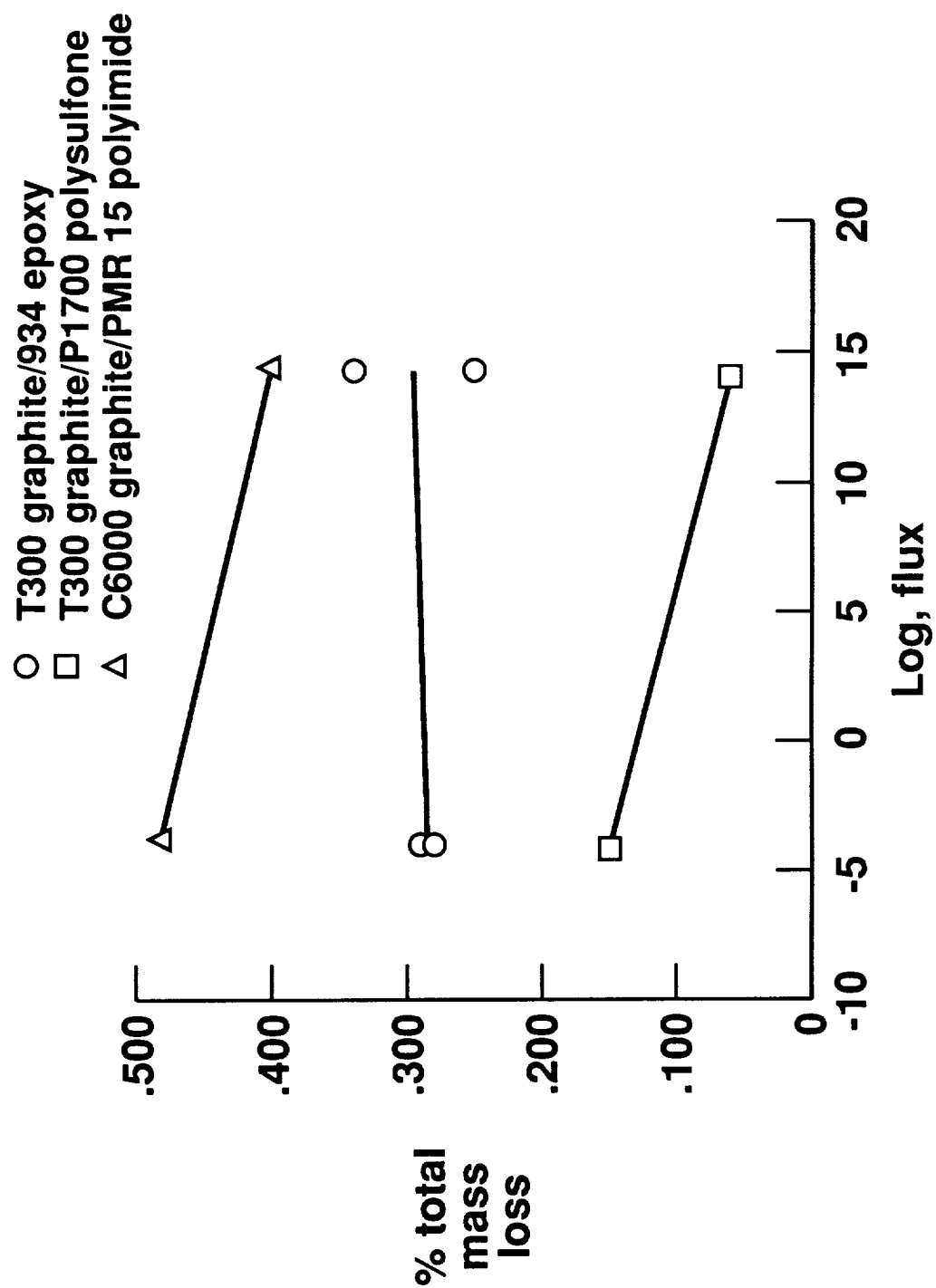


Figure 20. Example output using the spreadsheet screen in figure 19.

***User Request Form for MAPTIS and the LDEF Materials Data Base***

**Employee Name:**\_\_\_\_\_

**Company/Mail Code:**\_\_\_\_\_

**Work Address:**\_\_\_\_\_

**City:**\_\_\_\_\_ **State:**\_\_ **Country:**\_\_\_\_\_

**Zip Code:**\_\_\_\_\_

**Office Telephone Number:**(\_\_\_\_)\_\_\_\_-\_\_\_\_\_

**FAX:**(\_\_\_\_)\_\_\_\_-\_\_\_\_\_

**Signature:**\_\_\_\_\_ **Date:**\_\_/\_\_/\_\_\_\_

Do Not Write Below This Line

-----System Information-----

**Username:**\_\_\_\_\_ **Uic:**(\_\_\_\_\_.\_\_\_\_\_)\_\_\_\_\_

Check only one:

**Govt Contractor** \_\_\_\_\_ **Industry User** \_\_\_\_\_ **NASA (MSFC)** \_\_\_\_\_

**Bamsi/BCSS Programmer** \_\_\_\_\_ **EHO2 Personnel** \_\_\_\_\_ **NASA (OTHER)** \_\_\_\_\_

**NPSS/PSCN ID:** \_\_\_\_\_ **Initial Password:** \_\_\_\_\_

**Creation Date:** \_\_\_\_/\_\_\_\_/\_\_\_\_ **By:** \_\_\_\_\_

**Deletion Date:** \_\_\_\_/\_\_\_\_/\_\_\_\_ **By:** \_\_\_\_\_

Complete and fax to Rene Hitson/ John Davis (205) 544-5786. If you have any problems, contact Rene Hitson at (205) 544-6972 or John Davis at (205) 544-2494.

**Figure 21. User request form for access to MAPTIS and the LDEF Materials Data Base.**

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE June 1993		3. REPORT TYPE AND DATES COVERED Technical Memorandum
4. TITLE AND SUBTITLE LDEF Materials Data Bases			5. FUNDING NUMBERS WU 506-43-61	
6. AUTHOR(S) Joan G. Funk John W. Strickland John M. Davis				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) NASA Langley Research Center Hampton, Virginia 23681-0001			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) National Aeronautics and Space Administration Washington, DC 20546-0001			10. SPONSORING/MONITORING AGENCY REPORT NUMBER NASA TM-107757	
11. SUPPLEMENTARY NOTES Joan G. Funk, Langley Research Center, Hampton, VA; John W. Strickland, BAMSI Inc., 150 West Park Loop, Suite 107, Huntsville, AL; John M. Davis, Marshall Space Flight Center, Huntsville, AL				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Unclassified--Unlimited Subject Category 23			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) The Long Duration Exposure Facility (LDEF) and the accompanying experiments were composed of and contained a wide variety of materials representing the largest collection of materials flown in low Earth orbit (LEO) and retrieved for ground-based analysis to date. The results and implications of the mechanical, thermal, optical, and electrical data from these materials are the foundation on which future LEO space missions will be built. The LDEF Materials Special Investigation Group (MSIG) has been charged with establishing and developing data bases to document these materials and their performance to assure not only that the data are archived for future generations but also that the data are available to the spacecraft user community in an easily accessed, user-friendly form. This paper discusses the format and content of the three data bases developed or being developed to accomplish this task. The hardware and software requirements for each of these three data bases are discussed along with current availability of the data bases. This paper also serves as a user's guide to the MAPTIS LDEF Materials Data Base.				
14. SUBJECT TERMS Long Duration Exposure Facility, LDEF, Materials, Data Bases			15. NUMBER OF PAGES 30	
			16. PRICE CODE A03	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	